ICIS Signature

Instrumentation, Controls and Intelligent Systems

Herschel Smartt

March 10, 2006

ICIS Signature

- Provide fundamental scientific and engineering research *foundation* needed to support long term primary INL mission needs.

- People
- Technical expertise
- Technology development
- Infrastructure

ICIS Signature

- R&D collaboration
  - National and Homeland Security (*Craig Rieger*)
  - Nuclear Programs (*Bruce Hallbert*)
  - Science and Technology (*Derek Wadsworth*)
- Coordination & Planning
  - Centers (CAMS – *Charles Tolle* & CAES – *Leonard Bond*)
  - Business Lines (*co-leads*)
  - other Signatures (*Theory, Modeling & Simulation*)
- Capabilities development
  - LDRD
  - GPCE
  - Strategic hires
  - University/Industrial relationships

ICIS Signature

- · **Intelligent systems theory** and algorithm development.
- · **Control theory** and algorithm development.
- · **Advanced mathematical methods**.
- · **Human factors** research and HMI development.
- · Sensor theory and hardware development.
- · Data analysis and object/feature/event/target recognition theory and algorithm development.
- · Next generation embedded hardware (e.g. fpga) and software development.
- · Modeling and simulation of dynamic systems.
- · Systems design, integration, and prototyping.
- · Demonstration/field testing facilities.

ICIS Signature

Today

- Mechanistic and unintuitive controls
- Controllers that fail
- Sensors that must be validated and calibrated
- Robotic systems dependent on the human

2015

- Natural human interfaces to allow efficient interaction
- New class of robust, fail-safe, secure controllers
- Advanced self-calibrating and self-validating sensors
- Synergistic and autonomous systems for unstructured environments
- On-line condition and process monitoring

ICIS Signature

- LDRD portfolio
  - Next Generation Neutron Generator
  - In Situ Laser-Based Characterization of Fatigue Damage in High Temperature Environments
  - Multiple Sensor Array for Harsh Environments
  - Dynamic Autonomy for Mobile Manipulation
  - Joint System Prognostics for Increased Efficiency and Risk Mitigation in Advanced Reactor Instrumentation and Control

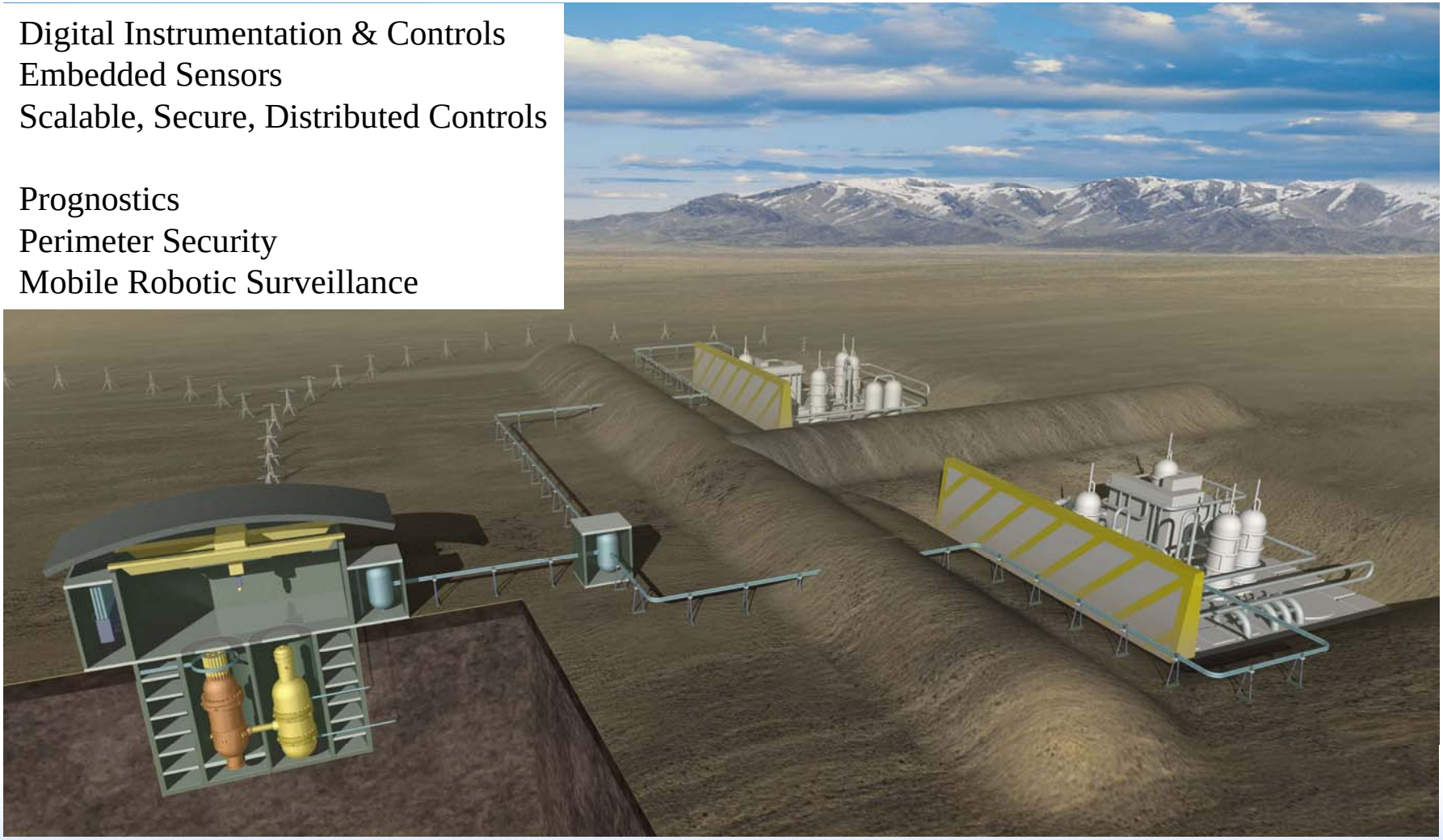
ICIS Signature

- Business targets
  - Next generation power reactors
  - Secure control systems & Contraband detection systems
  - Mobile robotics
  - Industrial & hot cell robotics

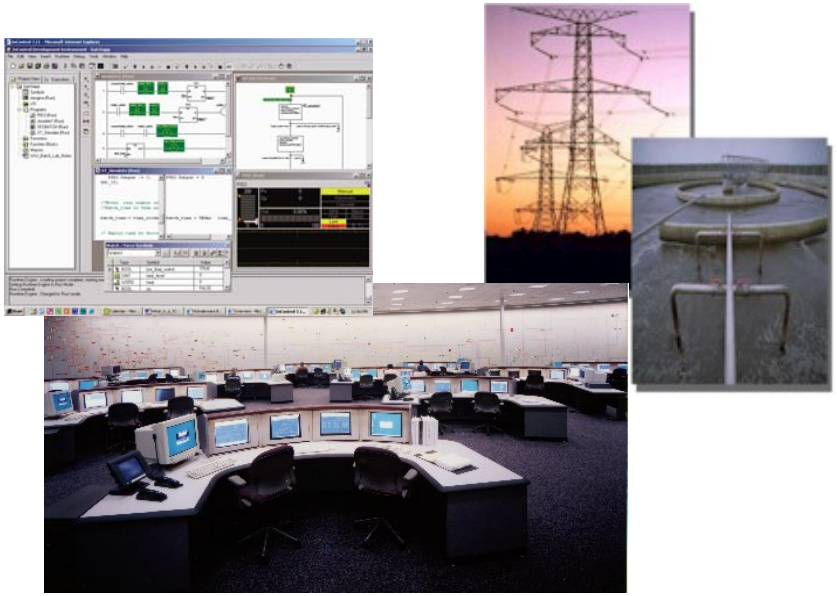
Next Generation Power Reactors

Digital Instrumentation & Controls
Embedded Sensors
Scalable, Secure, Distributed Controls

Prognostics
Perimeter Security
Mobile Robotic Surveillance



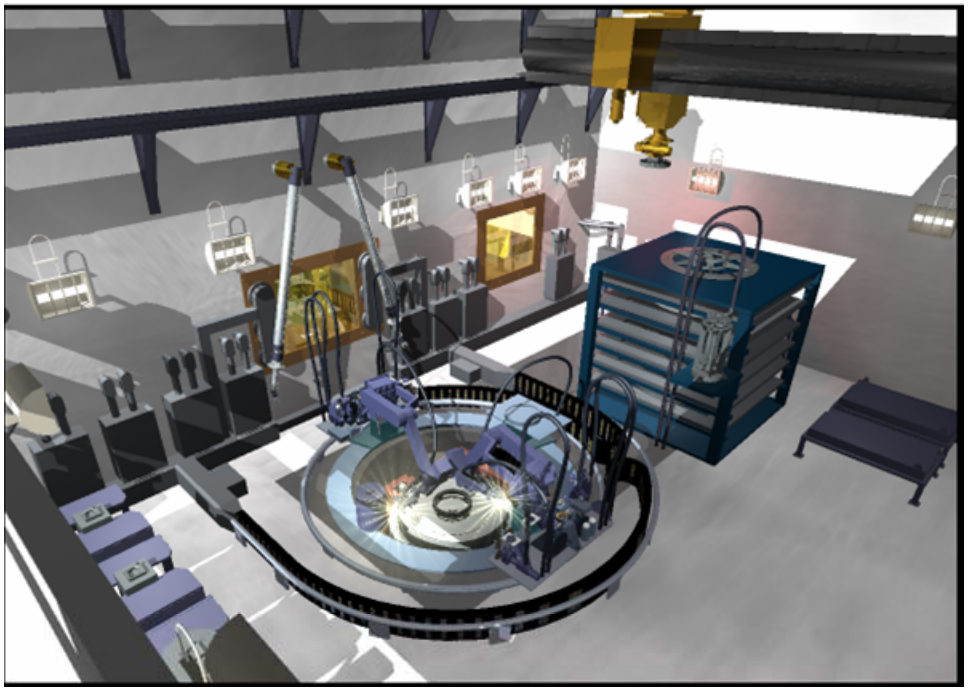
SECURE CONTROL SYSTEMS
CONTRABAND DETECTION SENSORS AND PLATFORMS

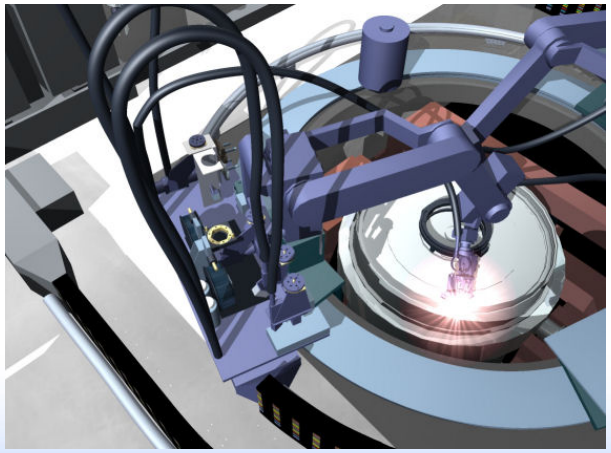


The National SCADA Test Bed (NSTB) applies a national testing environment to help secure SCADA communications and controls within the energy sector. It combines the expertise and resources of several national laboratories into a multi-lab partnership that helps to identify and correct critical security flaws in SCADA equipment and control systems.


Intelligence, Integration, and Interaction
INL
Idaho National Laboratory
intelligence Kernel
"The Next Generation"
Arcturus
T-15
Idaho National Laboratory

Industrial & Hot Cell Robotics





Cross-cutting technology team
(welding, inspection, robotics, hot cell & glove box design, operations)
National Spent Nuclear Fuels Program,
Yucca Mountain Program

Idaho National Laboratory

ICIS Signature

- PEMP Milestones
  - By July 30, 2006 establish **advisory committee**
    - Internal members (15) are in place, need charter.
  - By July 30, 2006, establish an INL **website**.
  - By September 30, 2006, conduct and report on a **workshop** to better define near term (2-5 years) science objectives and research approaches.
  - By September 30, 2006, outline and report on near term (2-5 years) **infrastructure needs** (facilities, instrumentation, and equipment).

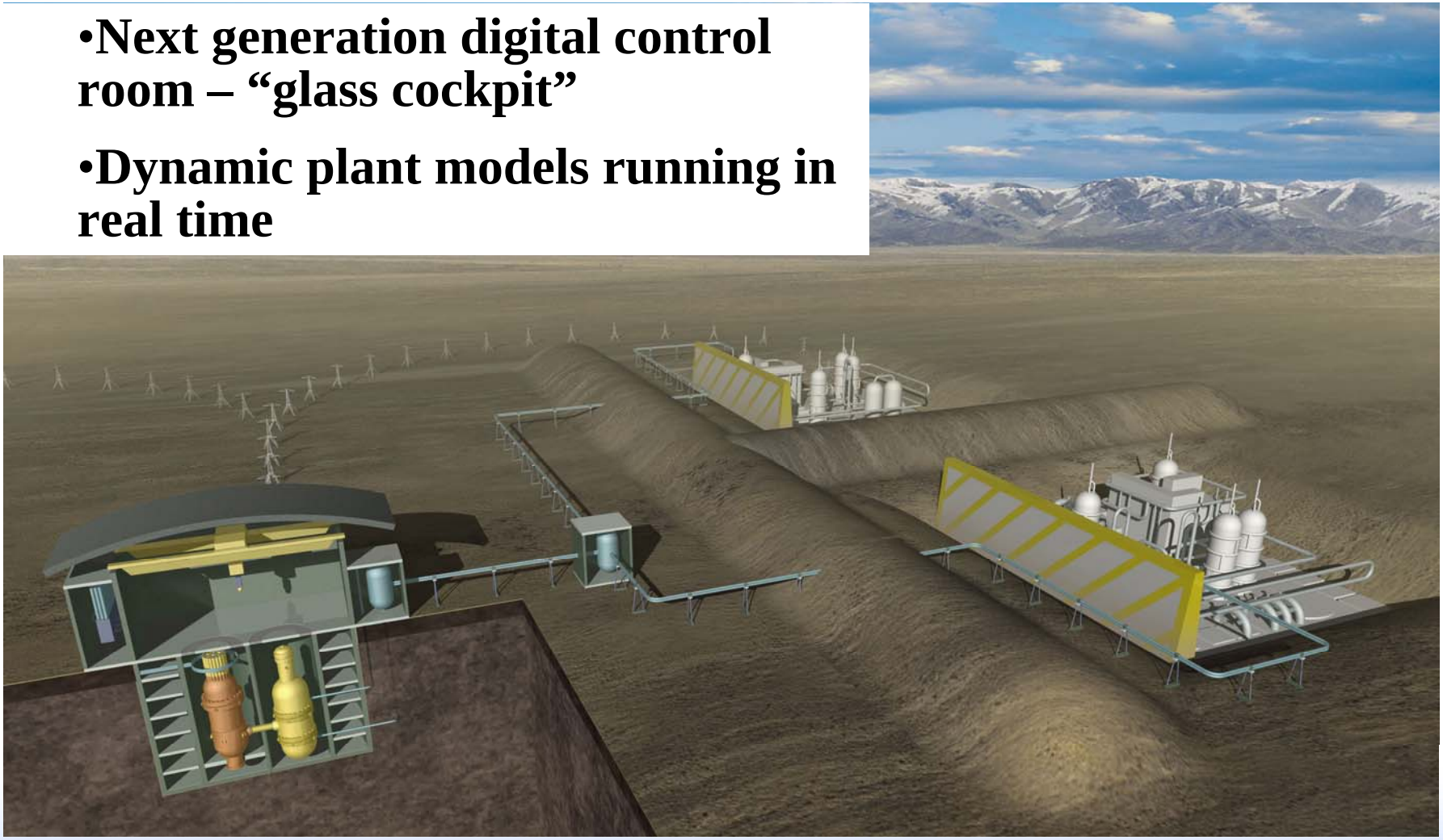
ICIS Signature

Other activities

- LDRD program
  - Project reviews
  - Portfolio review
  - Call
- Establish relationships with selected Centers, Business Lines and Signatures
- Identify dedicated computer (CAMS)
- GPCE needs
- Technical library coordination
- Congressional Support
- Symposium and/or Seminar Series
- **Strategic hires**
  - Curtis Nielsen, Ph.D. Computer Science – Jerry Harbour,
  - Search committee – Bruce Hallbert

Next Generation Power Reactors

- **Next generation digital control room – "glass cockpit"**
- **Dynamic plant models running in real time**



Idaho National Laboratory